



THERE IS NO MUD IN JOYVILLE

Gregory Ruffa
10380 Maya Linda Rd., Apt. C-303
San Diego, Calif. 92126
(619)-695-8647



for the Seventh Anniversary Issue of APA-TECH

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Let's see, how do you do one of these things again? ...ah! Well, hello again! I didn't intend it to be six months and more between visits, but I guess it is fatal to your productivity when you get out of the habit of writing. I just picked up the habit again a couple weeks ago and hope I manage to stay addicted for a while. I got the latest issue of the AIAA San Diego Section newsletter put together over Memorial Day weekend (just a month behind schedule) and, last weekend, wrote my fourth and last piece on the Comet for the Halleycon program book and some more stuff for **Pyro 38**. (Since the Convention is over the Fourth of July weekend and the Hanrahans are on the Committee, the next issue will probably be out in July.) Anyhow, I've now gotten back down in the stack to **APA-TECH** and just a couple zillion other things...

This contribution should come out cleaner than the last one I typed. The lift-off correction ribbon kept sticking to the paper or to the print ribbon and would only advance if I wound it by hand. I was afraid my four-month-old typewriter was already breaking down. Playing a hunch, though, I went to a different stationery store and asked for a correction ribbon for the Brother EM-100. They gave me a "low-tack" type, which had lower adhesion than the regular kind. The folks I usually shop at sold me the wrong stuff -- actually, the person I talked to there had said, "oh, they're all the same." I went back to the original shop; the people I talked to this time said, "oh yeah, you want the low-tack stuff." They were nice enough to exchange the partially-used box I'd bought there for a full one of the proper ribbon. The typewriter seems to work fine now...

It may work even better later this year, once I hook it up to my computer. Through an interest-free company loan, I bought an **Amiga** back in mid-April. Stores up in the Los Angeles area are pretty competitive, so I got the machine with the color monitor, expansion to 512K, and external disk drive for \$1595. When I first made enquiries so I could arrange the loan, the price was \$1890. I went up to Granada Hills with the check I'd been issued; the people there were reluctant to give me back \$300 in cash and I wanted some more things anyway. After a lot of juggling so that the check would be exactly consumed, I got an internally-regulated power bar, a **Scribble!** word processor disk, an **Amiga Pascal** compiler (marked down that week from \$199 to \$65), a copy of the DOS manual, and three boxes of diskettes.

I forewent a printer, figuring I have a letter-quality one in this typewriter. However, I failed to reckon with the problem of trying to de-bug a program from the screen: seeing your code on paper **does** make life easier (so much for how the computer was going to liberate us from paper-cluttered desks...). Once I buy the little box that plugs into the back of this machine, I'll be able to make actual use of the word processor (at least I'll go through a lot less Liquid Paper). The one problem I see at the moment is that I'll have to choose between justified text or proportionally-spaced fonts (such as this one). Does anyone know of a text processor available for personal computers that can justify letters when they're **not** all the same width?

(Hm, got through a whole page -- let's try another.) I've gotten a couple of toys in the last month for the computer. More software is becoming available for the Amiga, but it does make me nervous to hear about the design group at Commodore getting sacked. I felt like getting a couple of games, but shoot-'em-ups bore me pretty intensely. I have an exploration game called **Seven Cities of Gold**, in which you are the captain of an expedition westward from Spain to see what you may see. As you run into things, you begin to fill up a map of the "New World." You have a certain amount of money to distribute among ships, men, food, and trading items. Where you reach land, you can lead a party into the interior to explore the terrain or make contact with native habitats (these can range from a hunting tribe's village to an Aztec or Incan city). I'm at the novice level presently and the options for dealing with the people one finds seem limited to offering gifts and hoping to cajole them into trading goods for food and gold or to mowing them down and establishing a fort or mission by force. Like most of these games, though, as you keep playing, you keep finding new things the game will let you do. Sometimes, if you give the aborigines enough gifts, they decide to become Christians and ask you to found a mission there. When you return to Spain, you can visit the Court and see if they'll give you more funding (they are generally disinclined to do so, however). Right now, I'm in the soup back home for potzing off too many Indians; maybe next game, I'll get it right. The game starts in 1492 and keeps score on you until 1540 (you can play even longer if you wish, but you stop getting credit toward your achievements). It seems to handle weather and seasons correctly (it snows in South America in July, for instance) and the people you meet remember how you treated them before (they also talk to each other sometimes: don't shoot up one Aztec city and expect the next one you visit to welcome you). It's pretty well done and rather time-consuming: I've taken ten to twelve hours to go through 35 game-years. I've been disciplining myself to load it up when I really have nothing else to do. I've also got one on order called **The Halley Project**; we'll see what that one's like.

I also bought the set of two disks called **Aegis Animator/Images**, which is a color painting system and a separate one for animation. I've almost worked my way through the manual on painting so far. I think it'll be a long time before computers really replace the pencil, pen, and brush, but it's fun to work from a sketch made with down-loaded geometric figures up to a fully colored and modelled result. It's also nice to be able to experiment with color choices by just pushing buttons and sliding "tabs". I'm just doing cartoons for now to get used to the methods (I still dislike drawing with a mouse), but I hope to do something fancier soon. I expect to be working through the animation manual this month. Later this summer, most of the music synthesizing programs will be out and I have my eye on one of those...

The main reason I got the machine, though, was for scientific programming, which is what I've been doing most of the time. I have a program nearly de-bugged which calculates constant-acceleration trajectories through the Solar System. That's for a paper I'm doing for work. If things go well with that, it'll be ready for mid-August (more about that later).

I'm happy with my choice. I wanted a computer that I'd be able to live with for at least five years without getting too upset about all the later advances everyone will come out with. I think I have enough computation and graphics work to keep it occupied that long. There is also enough expansion capability in the design to make a still better machine of it next year. It's only crashed on me a couple times so far (and I think I helped it along). My biggest disappointment to date is that they didn't bother to put a clock-calendar into it; I can buy one from some outfit for \$50 or wait until I buy one of the Tecmar add-ons.

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I feel like I've illustrated the superstition "to speak of disaster is to summon it forth." I think a lot of us got to feeling that the Shuttle was pretty nigh invulnerable, since it had gone through twenty-four successful launches. Enough has been said about that tragedy by now and I don't feel I have much to add.

It does look, though, like our good luck has finally caught up with us and that we are now getting more of an idea of how reliable rocketry **really** is. Ariane is falling right in line with the historical pattern for new vehicles with the failure they had back on May 30th. (They haven't made things a bit easier on themselves by introducing **three** new boosters in five years.) What we are seeing is that the failure rate for new rockets still tends to be around 20% and is about 5% for established lines. All the effort that has gone into "man-rating" the Shuttle has just made it possible to skip over the traditional rocky part of vehicle development and to render it only as safe as, say, a Delta booster.

Plainly, in planning the orbiter fleet, the probability of failure must have been taken to be much lower. If an orbiter is to have an even chance of surviving for 100 missions, the rate for catastrophic failure must only be 0.7%. From the evidence, that probability is more likely to be between two to six percent, which puts the expected number of missions for an orbiter at 11 to 34. We **must** expect to lose more Shuttles.

Well, this is all very cold-blooded, I guess. The implication for me is that the Shuttle program has been grossly over-sold and that we (by which I mean **all** space-faring nations) are a lot further away from successful space development than we have liked to think. Extensive space commercialization is just out of the question when investors are faced with a five percent chance of losing their payload and losing a year or two of their time while they wait for the failure investigation to be completed and for a chance to get back on board with someone. Certainly, insurance groups have learned their lesson the hard way. It's also going to be pretty hard to plan large manned missions if we have to figure on losing a random five percent of the crew on the way up.

What seems absurd to me is that there are people who want to go out and repeat the mistake by simply building a replacement for **Challenger**. It seems that the expeditious choices are being made without much consideration for improving the present situation. I'd rather see the three billion dollars that the Administration is thinking about spending on another Shuttle put into work on improving the reliability of propulsion systems for a later generation of vehicles. I think the investment would be more than repaid in the reduction in the loss of lives and resources in continuing the drive into space.

* * *

This has generally thrown future plans into confusion everywhere. At work, I am now Mission Engineer in the Flight Mechanics group for the Magellan mission (formerly the Venus Radar Mapper, formerly the Venus Orbital Imaging Radar). Along with Galileo and Ulysses (the remaining ESA component of the International Solar Polar Mission), it is to be launched with the Shuttle/Centaur upper stage. Well, almost needless to say, many people are now even less in love with the idea of having big tanks of cryogenic propellant in the Shuttle's cargo bay. There is talk in Washington about cancelling the entire Shuttle/Centaur program, as it is felt by these people that the Centaur cannot be made safe enough to use from a manned vessel. This is certainly a legitimate concern, but it would now put a number of missions in difficult straits or completely out of reach.

Nonetheless, everyone is going along as if all of these missions really will happen unless the official word says otherwise. The present Shuttle manifest is

being drawn up as if the next launch will be in July of next year. That makes it impossible for Galileo and Ulysses to leave next summer. JPL is still holding out for launching Magellan in April of 1988, but there is stupendous pressure from other parties (spelled "DoD") to use the launch slot for other purposes.

There is another complication, which concerns those radio-thermal generators on Galileo and Ulysses, two on the former, one on the latter. Galileo is supposed to be carrying something like twelve pounds of plutonium. If it had been aboard **Challenger** in January, it is thought likely that the generator could have been picked up of the bottom of the Atlantic intact (something like this actually happened at

Vandenberg a few years back). But in contingencies where the Shuttle blows up on the pad or at low altitude, it looks like there would be more than enough over-pressure to disintegrate the generator casing. So work is underway to redesign the shielding on the generator to make **sure** it can't break open. This, of course, makes Galileo and Ulysses heavier and, thus, harder for Centaur to push into the proper escape trajectories. (The redesigns on the Shuttle itself will also reduce its payload capability.)

As if this weren't enough, the planets aren't cooperating either. Jupiter will be getting harder to reach by a direct route for the next few years, because it is moving further away from the plane of Earth's orbit. Galileo was supposed to follow what is called a "broken-plane" trajectory: the Centaur puts it onto a transfer ellipse in the Earth's orbital plane and Galileo's own propulsion bends the path to carry the spacecraft "up" in the direction of Jupiter. The fuel to do that is the same fuel Galileo needs to assist with maneuvers among the Jovian moons; the more mid-course deflection Galileo has to do, the fewer moons we get to visit. The best available way to cut our losses is to follow what is called a " Δ VEGA trajectory," in which Centaur puts Galileo into an orbit around the Sun with an aphelion somewhat beyond the orbit of Mars; near aphelion, Galileo makes a small maneuver (a "delta-vee") so that it meets up with the Earth again on the way in; passing 200 miles from Earth at high speed at the right moment bends the path of Galileo and accelerates it enough to reach Jupiter. The advantage of this technique is that it requires two-thirds the energy out of Centaur that a direct flight would (also, the amount of energy depends little on the year of launch). The drawback is that the total flight time to Jupiter will be around $4\frac{1}{2}$ years, instead of a bit over two.

NASA now has a "rule" that they will not launch more than one mission to a given planet during a particular opportunity. (Recall that Galileo and Ulysses were going to go during May to June of this year.) Any launch opportunities to Jupiter occur every thirteen months. The next one for a direct flight is July 1987 and is that November/December for the Δ VEGA approach. Well, next July is **certainly** out and it doesn't look like the radio-thermal generator problem will be solved in time for late next year. Meanwhile, launch opportunities to Venus recur every nineteen months. Magellan is on the Shuttle manifest now for November of 1989, but it might be the only planetary mission ready to go when the Shuttle is (it's solar-powered). Nothing is official, but some thought is now being given to making Magellan the first Shuttle/Centaur mission (assuming there will be such things). Sothings are pretty slow for us right now, but someone may decide to make us **real** busy by this fall. (My private bet in all this is that the next significant result from a planetary mission will be the Voyager 2 encounter with Neptune -- in August 1989...)

I guess someone thinks we're going to be pretty busy soon. My group is Trajectory and Performance, with twenty-one people in it; it is part of the Flight Mechanics section, which includes Guidance Analysis and Control Dynamics, with maybe some fifty people in all. In the next two months, we have thirteen new

employees and two summer co-op students joining us. That someone forgot that new employees need a place to sit. By commandeering some vacant non-office space, we can accommodate about five. The joke is going around now that everyone else will be asked to take their vacations sequentially, so some more desks will always be open. Of course, all of this will be solved when the building is remodelled (that's what they told me when I came out in 1984...). The belief is that there is going to be a lot of Shuttle-, Titan-, and Atlas-Centaur work in the future, except that there may no longer be a Shuttle/Centaur, Martin Marietta may opt to do their own mission analysis for Titan/Centaur, and no one's bought any more Atlases so far. (And I should know by now not to say things like this...)

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Anyway, I still have my work on Mars missions to keep me occupied. It looks like I'm going to be doing a lot of the analysis on my own computer, as we don't have an ephemeris in the Cyber for Mars after the year 2000. In the work I am preparing right now, we are looking at the 2001, 2003, and 2005 launch opportunities. A very large space-based Orbital Transfer Vehicle is used to send the mission on its way at minimal energy. An ion engine then takes over to accelerate the manned spacecraft continuously out to Mars. In past studies, some energy had to be wasted in bending the flight path to match velocities with Mars at the end. Here, we'll be using an aerobrake to become captured into Martian orbit, so we can probably fly straight at the planet. The first mission will probably be used to establish a base on Phobos (and perhaps on Deimos) in preparation for a Mars landing on a later mission. A second OTV is used for the transfer back to Earth, with the ion engine and aerobrake called into service a second time. I am looking at this, for purposes of the paper we are writing, purely as a dynamical problem, but I already see a bunch of technical problems in actually attempting such a mission. (Again, I will bet against such a mission occurring before 2010-2015.)

Bruce Cordell and I hope to have enough to say about the results by the end of July, so that I can present our paper at around 11 AM on Monday, August 18th at the AIAA/AAS Astrodynamics Conference in Williamsburg, Virginia. Now, this is really a masterpiece of dovetailing. The Worldcon is the following week. I plan to spend a few days with Kip Williams and Cathy Doyle in Newport News, Va. (just thirty miles down the road), then a few days with the Hartkopfs just outside of Atlanta, before going to the Marriott Marquis on Wednesday night. General Dynamics will pay most of my airfare, if my travel plan ever gets through the bureaucracy...

I have two quads reserved at the Marriott and still have plenty of space if you need a place to stay. Since it had worked out so well the last couple years, I'll be staying through Tuesday morning after the convention before going back to San Diego. (The theory is that you can unwind on Monday night and catch up on sleep before moving on. Historical experience shows that Higgins and I sit up talking to people until 6 AM or so...)

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Since November, I am now an uncle twice-over. The older of my two sisters brought her second child, Lauren Conway, into this world at around 2:30 PM on Veteran's Day. When I saw her during the holiday break, she didn't have too much to say for herself. If she turns out like her brother (and the indications are that she **will**), she may well make up for that. It looks like we have another techie in the making: my nephew started showing an interest in machinery at one-and-a-half. He began with fire engines and gas heaters and, as he approaches $2\frac{1}{2}$, has already

operated a diesel locomotive (well, the engineer let him sit on his lap and sound the horn). He is also a frequent visitor to my father's printing plant. I'm going to wait until he's about four or five and (when his mom isn't looking) maybe slip him a few books...

It looks like I'll be here for another year. I didn't get into school at any of the places I applied, which, on the whole, were slower than I remember them being in getting around to responding. By April, I decided that maybe it wouldn't be such a bad thing if I didn't get in, since there are a bunch of things I'm involved with that I'd rather not drop this year. I **am** still rather disappointed, but not awfully upset. I'll be giving it another try next year, with a few changes in strategy, like taking a few courses out here first.

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It is perhaps something in the way of hope for humankind that neither of the following superstitions have made their way into public thought. Reason may triumph yet!

1. Halley's Comet is responsible for the Shuttle disaster and the fall of Marcos and Duvalier. (When I thought this up in February, the other booster failures hadn't happened yet.) One of the other folks at work that I suggested this to said you could also blame the Comet for the record number of aircraft fatalities last year. (Whatever is going on here, '85 and '86 have really been bummers...)
2. TDRS/IUS is a jinx ship. The first TDRS had its Inertial Upper Stage malfunction, putting the satellite into a useless orbit. It took most of TDRS' fuel to salvage the launch and get it into geosynchronous orbit. If TDRS had still been intended for use as Advanced Westar, the mission would have been an almost total loss. As it is, most of TDRS-1's communications equipment has failed by now. And, of course, TDRS-B was aboard Shuttle Mission 51-L...

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oog Enough sour humor. Time for

MAILING COMMENTS

APA-TECH 38 AND 39

I'm so far behind that I'm only going to make a few remarks on these older numbers. First, I'd like to welcome **SHEILA, ERIC, KIRAN, BARRY, and ROXANNE** and to welcome back all of the old-time APA-TECHers who have returned after N years.

Dave May I offer my very belated condolences to you? I can only imagine how it was for you and I never know what to say to people that can possibly make them feel better about things after such a tragedy. I hope that you are feeling better these days.

Will we see you down here at Westercon in July?

Donna I think that GT would either have to be a lot more concentrated geographically or have quite a lot more members to work in the

organizational fashion that you described a while back. The only strong enclaves that I can think of that still exist are in Chicago and Kalamazoo (it doesn't seem like Houghton still is any more...). Further, it never struck me that there was a lot more than social cohesion holding GT together since at least 1980. The people who liked to work on projects tended to do their own individually, rather than in groups. Most of us are no longer students: if we are already doing something technical professionally, that doesn't leave a lot of time to do something else as a side activity. The enormous scatter of the membership over the last several years doesn't encourage working together. What I guess I'm getting at is that GT has seemed to be pretty much a social club since I got in around 1979. The makers of "blinkies" and the robot- and blimp-builders will continue despite these things, while the rest of us turn from our own pre-occupations to smile and applaud (especially ten-thumbed theoreticians like me...). I'm satisfied that, at least for the present, GT has two reasonably healthy publications going again. You want maybe a recruitment drive in Atlanta?

Guy W. So you're working for Stanley Ovshinsky? I can remember reading about him in the **New York Times** back around 1968, talking about amorphous silicon chips and flat TVs you could hang on your wall and suchlike. I'm still wondering what will come of that. But you at least sound happier about working there. (If it's of any interest, Edward Teller seemed enthusiastic about amorphous silicon when he spoke out here in November.)

It surprises me how often the idea of launching rockets from high-altitude balloons re-emerges. The problem is that altitude is relatively unimportant in getting into orbit: **velocity** is the essential parameter. To launch from the surface into, say, a 150 statute mile orbit (you can't **stay** in orbit at 100 miles -- drag makes you drop out in less than one orbit) takes around 21,000 mph of velocity change from the rocket (about 17,400 mph for the orbit itself and the rest in losses, most of it in fighting the Earth's gravity field). Starting from 68 miles up will eliminate almost all of the losses due to atmospheric drag and steering the rocket, but that only comes to some hundreds of miles per hour. At that altitude, local gravity is 96.7% of what it is at the surface, which doesn't help a lot. Being closer to the target altitude **does**, since gravity loss is dependent upon the amount of time spent accelerating; unfortunately, the rocket won't save all that much time in trying to become orbital.

Let's be generous and say that the rocket will now have to supply only 19,000 mph of velocity change, by cutting the total losses roughly in half. Since this is being launched from a balloon, the rocket will probably use solid propellant or hypergolic fuel, which are less energy-efficient than cryogenics, but don't require much support equipment. The ratio of the initial weight of the rocket-plus-payload to the weight of the burned-out-rocket-plus-payload is in the range of 12 to 32.

That sounds pretty reasonable, except that launching a 10-gram payload doesn't mean that you would build a 120-gram rocket. The levels of pressure inside the combustion chamber require a lot of "useless" weight devoted to structural strength; this can't be preserved very well by scaling the rocket down. As a result, the very smallest rockets that can put a payload into low Earth orbit must still be fairly "large." Looking into **The Illustrated Encyclopedia of Space Technology**, the smallest rocket I could find is the Japanese Lambda-4S from the early 1970s. It used solid propellant; with a launch weight of 20,905 pounds, it could put a 53-pound payload into low orbit. The American Scout rocket uses solid fuel, weighs 47,000 pounds, and can put maybe 800 pounds into low orbit. (You can see that it's a very non-linear situation.) Starting from a balloon will improve your "payload capability" a bit, but won't help you shrink the rocket much. (Launches from jet aircraft aren't much of an improvement, either, as was discussed here a while back. The anti-satellite missiles we shoot from F-15s don't come close to orbital speed.)

Sam: I haven't a lot to add to your comments on our educational system that I haven't said before. I spent about a year-and-a-half in the University of Illinois Education Department and am satisfied that university academicism will be the ruination of education, just as the snootier university business schools wrecked industrial management. It seemed more important to be able to know about the currently accepted sociological and psychological models of the educational process than about the subject you were going to teach. The production of papers is as important in those departments as anywhere else, so that doesn't leave a lot of time to **learn** the literature or math or science or history that you should understand if you're going to help anybody else. I'd prefer to see the barriers between academia, industry, and government agencies lowered, so that people who do certain kinds of work for a living can take time to teach students. (GD does that a bit: a few of the classes in aerospace engineering at San Diego State U. are taught by our employees.)

Everything **doesn't** collapse, of course, because a lot of good students are getting through the system and into useful work. What bothers me is that a lot of other kids are getting left out in the cold.

APA-TECH 40

Cover Not bad, not bad at all... Higgins manages to get simultaneous cover appearances on **APA-TECH** and **Pyro** and he hasn't written anything for either one in close to two years! (There's a "goad" if ever I heard one...) I had to read through the issue to understand why the reference to bears was essential (much too much more on this exciting controversy in **Pyro 38**, out in July). I like the song verse, Steve -- it has possibilities. How does the rest of it go?

Rod I quite agree with the point in your article. Every human (save those unfortunates with certain types of brain damage) has a great deal of native intelligence. Some of the problems in our society which must be overcome are those that cause human talent to be wasted. The perception that intelligence is something that possesses a linear scale is part of what gets in the way of making such changes.

Eugenics is immoral precisely because it attempts to impose someone's imagined version of "human perfection" upon "the Masses." The Great Minds of our history came about from the successful cultivation of talent, a result which cannot simply be **bred** for. (I can't help wondering if the "parents" of children produced with the aid of the Nobel Prize winners' sperm bank will become upset if "their" children fail to take the Prize also. Will they want their money back or what?)

Roxanne Thanks for the self-interview: you've just saved me a lot of investigative work. I'm glad to hear things are well with you. It was good talking with you (telephonically) at the "Nuclear Arms."

I'm afraid the "technocracy" is already here, just as incompetently run as you might expect. The government tries to get help to people through layers of policy makers, funding jugglers, and bureaucrats, with the result that a large portion of the resources and human effort are uselessly dissipated. I see no reason to expect that to get much better (or much worse) in the foreseeable future.

As for the resurgence of "the Sixties," I would only expect to see that in this country if we took another major national upswing. The youth of that age (I consider myself just a few years late to be included) grew up with the rising expectations incurred in the Fifties and rebelled when they began to feel that political self-indulgences like the Vietnam War and the Apollo program were keeping America from bringing about really important changes for all of humanity. (This is my view at the moment -- feel free to rip it to shreds...) By 1972 or so, it

was becoming clear that things here had crested and that we probably couldn't (or wouldn't) do all those things we'd once believed we could (certainly not after spending billions on luna-forming Indochina...). Since then, it's been a downward slide into Muddling Through, security-seeking, "lowering our expectations," and self-parody. (Could the Reagan Administration be far away? American humor hasn't been Really Funny since we stopped having Dick Nixon to kick around...)

Yes, I'm in favor of helping the rest of humanity because they are fellow humans (even if some of them don't think **we're** fellow humans...). But our society lacks any **real** dedication to the task and some of the things we do to "help" border on the imbecilic, partly from plain ignorance of the cultures and genuine needs of other peoples and partly from our general inability to separate efforts to help from selfish political motives. (A note: when I say "our society," I am speaking of the industrialized nations on both Sides.)

The business here in **APA-TECH** about anticipating the solid rocket booster failures was not much more than coincidence (we were likely to be right eventually...). It was one of the most obvious flaws of the Shuttle system. It's been interesting to read in **Aviation Week** over the last few months about just how many possible causes of "catastrophic failures" the Shuttle possesses. NASA was **not** ignorant of the SRB problem -- it was just one of a sizeable list of things they never had money to deal with anyway. The solid rocket issue was "closed out" simply because it had sat on the list so long without being fixed. The O-ring trouble just stands out now because it's the one that clobbered us this time. Which item will be the next one?

I actually finally heard someone in Congress suggest that they might have contributed to the problem by not granting enough money to NASA when the Shuttle was being designed and built. (Water under the bridge, now...) America got the best reuseable vehicle they were going to get for the amount of money they were willing to spend on space in the Seventies, in my opinion. As so often happens, lives were lost so that money could be saved. (It amuses me that Fletcher has been put back in charge at NASA, considering he was the guy who presided over things during the Shuttle's design phase.)

Barry Oh, poo on the Comet! Here I went and wrote four articles about it for Westercon and I didn't even get to see it. Actually, the nightly weather around San Diego was wretched through most of the spring. From February to late May or so (definitely "or so" **this year**), it clouds up at low altitudes soon after sunset and the Sun doesn't break through until at least ten the next morning. (San Francisco isn't the only place in California with this lovely phenomenon.) Some of the folks I work with tried four times to go out east, deeper into the desert, for a look. It was all a waste. The first three times, it stayed cloudy; the second time, it rained. On the fourth and final try, I failed to connect up with their group, which took off for Mt. Laguna at ten PM (the other times, I chose to stay at home and sleep). They drove for an hour, got to the site, and looked at the Comet with binoculars for a bit. By midnight, when they finally got two 6" reflectors set up, a little finger of cloud came over -- and guess what it covered up? Then the rest of the scuzz rolled in. I saw Comet West back in '76: I don't think I missed much this time. I enjoyed the piece you wrote, though.

Barry's Book of Bears, indeed! The information I've had available to me always said polar bears are bears. Those other guys **must** have been thinking of pandas (and, as you've said, were wrong, anyway).

Bonnie In regards to your 'zine title:

4. *The meaning of "never."* It has been said* that "six monkeys, set to strum unintelligently on typewriters for millions of years, would be bound in time to write all the books in the British Museum." This statement is nonsense, for it gives a misleading conclusion about very, very large numbers. Could all the monkeys in the world have typed out a single specified book in the age of the universe?†

Suppose that 10^{10} monkeys have been seated at typewriters throughout the age of the universe, 10^{18} s. This number of monkeys is about three times greater than the present human population‡ of the earth. We suppose that a monkey can hit 10 typewriter keys per second. A typewriter may have 44 keys; we accept lowercase letters in place of capital letters. Assuming that Shakespeare's *Hamlet* has 10^5 characters, will the monkeys hit upon *Hamlet*?

(a) Show that the probability that any given sequence of 10^5 characters typed at random will come out in the correct sequence (the sequence of *Hamlet*) is of the order of

$$\left(\frac{1}{44}\right)^{100\,000} = 10^{-164\,345}$$

where we have used $\log_{10} 44 = 1.64345$.

(b) Show that the probability that a *monkey-Hamlet* will be typed in the age of the universe is approximately $10^{-164\,316}$. The probability of *Hamlet* is therefore zero in any operational sense of an event, so that the original statement at the beginning of this problem is nonsense: one book, much less a library, will never occur in the total literary production of the monkeys.

* J. Jeans, *Mysterious universe*, Cambridge University Press, 1930, p. 4. The statement is attributed to Huxley.

† For a related mathematico-literary study, see "The Library of Babel," by the fascinating Argentine writer Jorge Luis Borges, in *Ficciones*, Grove Press, Evergreen paperback, 1962, pp. 79–88.

‡ For every person now alive, some thirty persons have once lived. This figure is quoted by A. C. Clarke in 2001. We are grateful to the Population Reference Bureau and to Dr. Roger Revelle for explanations of the evidence. The cumulative number of man-seconds is 2×10^{20} , if we take the average lifetime as 2×10^9 s and the number of lives as 1×10^{11} . The cumulative number of man-seconds is much less than the number of monkey-seconds (10^{28}) taken in the problem.

I have checked these calculations. You'd better start typing faster...

Rats! You didn't even get credit on the postcard for the map. I note that one entry became the "Michigan Historical Museum" on the back.

Did they say anything at GM about coupling ETAK with the Global Positioning System (a/k/a Navstar)? I've heard suggestions to indicate that we might start seeing GPS receivers in top-of-the-line American cars in five to ten years. (It's already being made available for private aircraft.) Your car would usually be able to locate itself to within ten meters -- not so great for city driving ("We appear to be driving through the Chrysler Building's lobby."), but should be fine for highway and interstate trips.

Alice Welcome back: haven't seen you here since the days of fluid flow equations. Your work shift rotations sound vastly more maddening than mine were five years ago. At least Western Union had the decency to shift us 180° only every four weeks.

I'll bite -- why is the attack cat called "Coriolis"? Does it attack its own tail a lot?

Guy C. I guess I talked to you on the phone back around the time of that issue. Your adventures on leaving Kenya seem more fun to read about than they probably were to experience. How fortunate for you that general education there isn't better or that airline employee would have known how many kilos 80 pounds are!

from *Thermal Physics*,
2nd edition, by
C. Kittel and H. Kroemer
(New York: W.H. Freeman
and Company, 1980),
p. 53.

"Gee, Dr. Hofstadter,
looks like a severe
case of INNUMERACY
to me..."

Donna I've never imagined that GT would be the group to build starships and the like -- it's always been more on the hobbyist's scale of activities. (Nothing wrong with that. And we certainly could be one of the groups that **think** about how starships could be built...) What I've been trying to get across to Franz Zrilich and Victor Koman and a number of other people I've met is that **no one** is going to build a starship of any kind soon, much less one with a human crew. (Some of these people then decide that if you point out the size of the obstacles to be overcome, then you are a mindless conservative and are not fit to be spoken to again. Is this attitude really necessary?) I've come to accept interstellar travel as one of those things which will not happen in my lifetime (assuming I don't make it past 2050). What's starting to bug me is that I'm not even sure I'll get to see (or be!) people standing on Mars (Cordell doesn't like me to talk that way, though...).

Tsk! The things I miss by not living in the Midwest. Who sez it's all happening here on The Coast? That's Ishercon, Capricon, Dayton, Ann Arbor, West Chicago, and fixing up your house that I've missed this year, and it's only June!

Who says you have to give up "childlike wonder" for "respectability"? I have a "respectable" job working on all sorts of "silly" ideas right now. It is important not to confuse "childlike qualities" with "childishness" -- a lot of "grownups" let go of the wrong part!

Marty At last!! The name of the mystery diner and the town it's in, written down on actual **paper**! Now, when am I going to be near Lyndon Station, Wisconsin next? Back twenty years for lunch, you say? Did the place have 5¢ coffee and a Wurlitzer in the corner? What kinda car do you drive, again?

About the "radical ideas" panel and criminal justice -- someone once said that they were always amazed at "the rapidity with which intellectuals will embrace fascism." I've heard some very disturbing ideas from people who think their suggestions would solve a lot of problems, provided **they're** the ones who would implement them...

* * *

I started writing this back around June 7th (in the meantime, **AT 41** showed up) and it's now June 17th. A few things have happened since then. I've finished reading about the painting system on my Amiga and am now well into the animation system. (I haven't figured out how to get rid of a painting yet.) I reached 1540 in my exploration of the New World, having personally seen 93% of it, becoming fairly wealthy, and finally making peace with the Incas; I never got above a "fair" rating, though. I'll be starting over at journeyman level when I have time for games. I have to get back to flying to Mars...

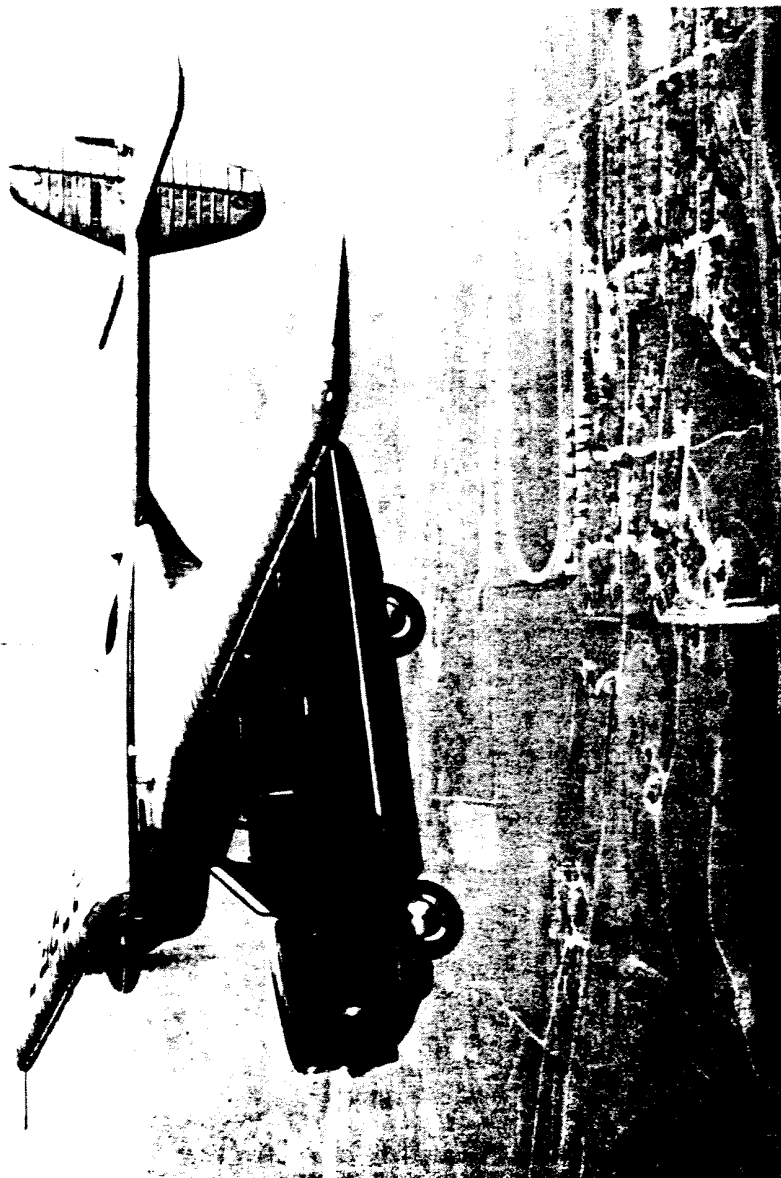
We've been getting some rumors about the Shuttle at work. It may turn out that the re-design work will keep the orbiters grounded into mid-1988. That would mean Galileo wouldn't launch until the end of '88 (with arrival at Jupiter 4½ years after that), Ulysses around September of '89, and Magellan in November of '89 (looks like I'll win that bet with myself). Atlas will be launching again by perhaps late 1988 if we scare up enough business, which is quite possible.* Shuttle/Centaur is still alive so far. They've started moving people around in our building, so our sixteen new group members will get their own desks after all (that's good, because six of them are here already!).

Our software person finally got the Cyber to read the new planetary ephemeris that JPL sent us, so we can now look at missions up to the year 2000. I have now started studying the 1989 Magellan launch, which is to leave between October 28th and November 16th of that year and will arrive February 23, 1990. (I couldn't do this before today because we couldn't see past 1 Jan. 1990 until now.) I will also be using this for some of my Mars work.

(continued on page 15)

* Next scheduled launch (AC-66/FLTSATCOM) is 28 August.

"Let's talk about your car!"



Consolidated Vultee's New Design Could Fly and Drive

[to a tiny instrumental background]: "It's the Car ... of the Future!
The Car...you will own... in.. 1960..."

GD Flashback

Flying Car Was Designed for Salespeople By Joe Stout

Possibly one of the most unusual projects in the history of aviation and General Dynamics was the development of the Flying Car, a vehicle designed in the mid-1940s for business travel on the road and in the air. It was the dream of T.P. Hall, a design engineer at the Consolidated Vultee Aircraft Corp.

Hall envisioned the Flying Car as ideal transportation for salespeople who covered a wide territory. In its planned use, the vehicle would be flown to an airport where its wing assembly could be removed and stored, making the automobile portion available for local ground travel.

The central figure in its development was Tommy Thompson, who retired from Pomona in 1970 after a career that also included assignments at Convair and Fort Worth. He worked on the project from its beginning in a garage in San Diego until it ended shortly after a crash landing.

Thompson was employed as a mechanic at Consolidated Aircraft in San Diego from 1936 until 1940, when he joined Vultee. In 1941, he returned to San Diego and worked there through World War II. Consolidated and Vultee merged in 1943 and then merged with General Dynamics in 1954.

In 1945, he left Consolidated Vultee and went to work for Hall, who previously had left the company and had begun to make the Flying Car a reality. Thompson and two other former Consolidated Vultee employees went to work assembling the vehicle from materials that included war surplus goods.

It was made of light-gauge aluminum, with fabric-covered wings, elevators and rudder assemblies. The workers followed Hall's blueprints, which directed that the body of the car part be made first, on a frame of welded steel tubing. Since no forms or tooling were available, the parts were shaped with a rubber hammer, hammering with a sandbag so as not to damage the material. Then the pieces were smoothed with a planishing hammer.

Aluminum was then rolled into 7.5-inch diameter tubes, which were used for the wing spars and tail boom. Wing ribs were fabricated by an outside contractor in Los Angeles, and the engine mount was built from steel tubing.

A 90-horsepower, air-cooled Franklin engine with in-line cylinders was used to power the airplane portion in the original prototype. The car portion was equipped with a four-cylinder engine from a 1945 Crosley automobile, installed in the rear.

The automobile's wheels were mounted on hydraulic cylinders that could take the shock of landing. The pilot — or driver — could lock them in an up position during flight to reduce wind resistance.

The wing assembly was attached to the car with three 3/4-inch bolts, two in the rear and one in the front. One day, the workers on the project were informed that the operation had been sold to Consolidated Vultee. The project was moved to the main plant at Lindbergh Field in San Diego, and the three-man assembly team was joined by employees from the company's Experimental Department. "We were given the best haws by some of the old-timers at the plant, but we kept our spirits up and began to cover the wings and other parts that needed fabric," Thompson later recalled.

Some of the controls for the airplane were fitted to the steering wheel of the auto, and a foot pedal was installed to operate the rudder. Elevator controls were installed so as to be disengageable when the wing assembly was removed.

One day in July 1946, some members of the crew were told that they would be required to work a 24-hour shift. They worked all day and into the night, and at 5 a.m. the next day, the airplane was rolled onto Lindbergh Field for its first flight.

A Consolidated Vultee test pilot arrived at the field with Hall, and the pilot took the craft to an altitude of about 2,000 feet and made several passes over the field. "After landing on all four wheels and taxiing over to us, he rolled down the window and said, 'I like it,'" Thompson reported.

A short while later, Thompson recalled, "A highway patrolman came to the Lindbergh Field entrance and said it was either time for him to get a new book for writing tickets for flying cars, or else to change his brand of liquor."

The original prototype logged more than 100 hours of flight time in the following months. A second prototype was built incorporating features planned for the production Flying Car, including a Pratt & Whitney 190-horsepower radial aircraft engine and a fiberglass car body. The second model had an air cruising speed of 125 mph and a top speed of 140 mph. As a car, it had a top speed of about 65 mph, according to Thompson.

The vehicle received considerable publicity, as several flights were made for the press.

"One morning, a test pilot and the flight engineer wanted to make some speed and altitude checks," Thompson said. "I was on the field and asked if they needed more gas. They assured us that they would only be gone 20 minutes, and there was enough fuel for half an hour."

"After 20 minutes, we began to watch the sky for them," Thompson said. "After 30 minutes, we knew something bad happened. About 45 minutes after takeoff, we received a call from Chula Vista. They had run out of fuel and crash landed in a field. The Flying Car was badly damaged, but no one was seriously hurt, fortunately."

Thompson said the vehicle was repaired and made a few more flights before Consolidated Vultee resold it to Hall. The last Thompson heard, it was in storage at El Cajon, Calif. Hall retired to New York, and the crew was transferred to work on missiles being developed by Consolidated Vultee.

from *General Dynamics World*, May 1986

PERSPECTIVE

from our Responsibility in Journalism Department:

Michael Tuck

10NEWS, P.O. Box 85347, San Diego, California 92138, Telephone (619) 237-1010

Shortly after World War II, the U. S. Military set a new high-water mark for "hairbrain schemes." What the Generals wanted was a new airplane... propelled by nuclear power. It works for ships, they reasoned, so why not for airplanes? Well, they tossed the idea around for more than a decade until President John F. Kennedy finally figured out that ships don't crash into crowded neighborhoods, but airplanes sometimes do. Kennedy killed the project. As long as he was President, the U. S. would not build a flying nuclear bomb.

Well, brace yourself, and move forward to the Year 1986. Nobody's talked much about this yet, but a flying nuclear bomb is exactly what NASA was planning to launch, before the Challenger exploded this January. We now learn--incredibly--the next shuttle launch was scheduled to carry plutonium-238 - the most toxic, dangerous substance in this universe. Nearly 47* pounds of it, fuel - to power twin rockets† NASA hoped to launch from space.

Now picture the frightening scenario that could have been: Another booster malfunction and 47 pounds of deadly plutonium blown to smithereens right near a major population center. The question is, had the explosion occurred on the next launch instead of this one, just how catastrophic would that have been?

The Energy Department admits that that much plutonium-238 is enough to give five billion people lung or bone cancer - under "worst case" conditions. And, just what are "worst case" conditions? The Department won't tell us that, saying "that information is classified." Apparently, "worst case" means prevailing winds spreading the poison to other countries. So the Government won't release its study of "what might have been" - too sensitive.

But, sensitive or not, I think it's time congress fully investigates this hairbrain scheme; and, just like President Kennedy did 25 years ago, put a stop to it for the future. We've already had one tragedy. Believe it or not, it could have been much, much worse.

I'm Michael Tuck, and that's my perspective.

*! ? No one I've talked to knows where he got this number. The total is about 18.

† The "rockets" are Galileo and Ulysses.

AIRD ON KGTV MARCH 18, 1986

I'd almost hate to tell Mr. Tuck that the U.S. and U.S.S.R. have been launching these "bombs" for at least twenty years... I hope he never finds out about the SP-100 program or he'll put himself into Intensive Care... His concern is legitimate, but not overlooked by NASA and DoD.

The company will be paying for my entire trip through the Southeast in August (due to the peculiar way they buy airline tickets). I am listed in the current issue of **Aerospace America** (under AIAA Meetings) as presenting paper AIAA-86-2015-CP during Session 7 of the AIAA/AAS Astrodynamics Conference, so I guess I'd better get back to work on it (or I'll have to find my own way to Atlanta...)

* * *

As long as people have been going around the last few issues trying to start an argument, let's try this. What do you folks think about SDI? I'm quite against it, but not for the reasons a lot of scientists have offered. I have little doubt that if we expend enough money and human effort on it that we can make it "work," at least technically. What I object to is the phoniness of its major selling point: that it will make nuclear weapons obsolete. It may turn out that it can make ICBMs obsolete, but that, of course, is not the same thing. I certainly don't believe for a moment that it will end the arms race -- by 2000, the various parties will have simply shifted their expenditures to new forms of countermeasures. ("The history of warfare is but a series of counter-countermeasures.")

Someone finally wrote to **Aviation Week** and said in print what seemed clear enough for some time: that many of the proposed devices, particularly the space-based ones, would make perfectly good **offensive** weapons. This would put both Sides on the verge of abrogating yet another treaty, that governing peaceful uses of space. If one wished to be paranoid, one could suggest that there is a "hidden agenda" to produce these instruments for just those purposes. (I haven't become that paranoid yet, have I?)

I also find objectionable the moral smarminess on the part of some of the researchers in the field, the ones who take the position "Who cares if SDI works or not? Look at all the **money** the Government is giving us to research all kinds of neat stuff, like X-ray lasers and supercomputers and VLSI!" I almost prefer the people who sincerely **believe** they are going to liberate humanity from the Scourge of Nuclear War.

I think the only genuine solution to the arms problem is non-military and obvious enough. But, since it is something the human "tribes" seem disinclined to do, it is also an utterly impractical solution.

Be prepared to pay for anti-SDI weapons in thirty years...

* * *

Well, this has been a depressing enough issue. But it's let me say a number of things I've been concerned about lately and have been talking to people at work about. I was going to talk about some of the places I've been and things I've been involved with over the last six months, but that's getting a bit stale and I need to **finish** this 'zine.

I hope to see some of you at Halleycon in a couple of weeks. I may be on a few of the panels there. Otherwise, I expect to see most of you in Atlanta (and I still have room space for the "truly needy"...). I may even be at Ishercon this year -- who can say?

I'll be seeing your contributions in my mailbox August 1st, in any event. (Won't I?) Take care and (*oop* *ack*) "have a nice day!"